THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

ETV Joint Verification Statement

TECHNOLOGY TYPE:	**MOBILE DIESEL ENGINE AIR POLLUTION CONTROL**
APPLICATION:	**CONTROL OF EMISSIONS FROM MOBILE DIESEL ENGINES IN HIGHWAY USE BY DIESEL OXIDATION CATALYSTS**
TECHNOLOGY NAME:	**CLEAN DIESEL TECHNOLOGIES, INC. FUEL-BORNE CATALYST WITH CLEANAIR SYSTEM'S DIESEL OXIDATION CATALYST**
COMPANY:	**CLEAN DIESEL TECHNOLOGIES, INC.**
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The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations; stakeholder groups, which consist of buyers, vendor organizations, permitters, and other interested parties; and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Air Pollution Control Technology Verification Center (APCTVC), one of six centers under the ETV Program, is operated by Research Triangle Institute (RTI), in cooperation with EPA's National Risk Management Research Laboratory. The APCTVC has evaluated the performance of an emissions control system consisting of a fuel-borne catalyst for mobile diesel engines used with a diesel oxidation catalyst muffler.

ETV TEST DESCRIPTION

All tests were performed in accordance with the *Test/QA Plan for the Verification Testing of Diesel Exhaust Catalysts, PM Filters, and Engine Modification Technologies for Highway and Nonroad Use Diesel Engines* and the *Test-Specific Addendum to ETV Mobile Source Test/QA Plan for Clean Diesel Technologies, Inc. 0.5Pt/7.5Ce Catalyst & CleanAir DOC*. These documents are written in accordance with the applicable generic verification protocol and include requirements for quality management, quality assurance, procedures for product selection, auditing of the test laboratories, and test reporting format.

The mobile diesel engine air pollution control technology was tested at Southwest Research Institute. The performance verified was the percentage emission reduction achieved by the technology for particulate matter (PM), nitrogen oxides (NO_x), hydrocarbons (HC), and carbon monoxide (CO) relative to the performance of the same baseline engine without the technology in place. Operating conditions were documented and ancillary performance measurements were also made. A summary description of the ETV test is provided in Table 1.

Table 1. Summary Description of the ETV Test

Test type	Highway Transient Federal Test Procedure (FTP), heavy-duty cycle
Engine family	LCE0505FAC5
Engine make–model year	Cummins Engine Company–1990
Service class	On-highway, heavy duty diesel engine
Engine rated power	206 kW (275 bhp) @ 2,000 rpm
Engine displacement	8.3 L
Technology	Clean Diesel Technologies' fuel-borne catalyst with CleanAir System's Diesel Oxidation Catalyst
Technology description	A platinum/cerium fuel-borne catalyst (0.5Pt/7.5Ce ppm) in ultralow-sulfur diesel (ULSD) fuel combined with a diesel oxidation catalyst (Model CPD0950)
Test cycle or mode description	One cold-start and three hot-start tests according to FTP test
Test fuel description	EPA standard low-sulfur and ultralow-sulfur No. 2 diesel fuels per 40 CFR Part 86.1313
Critical measurements	PM, NOx, HC, and CO
Ancillary measurements	NO, NO_2, CO_2, exhaust back-pressure, exhaust temperature, and fuel consumption

VERIFIED TECHNOLOGY DESCRIPTION

This verification statement is applicable to Clean Diesel Technologies' platinum/cerium fuel-borne catalyst (FBC) at 0.5 ppm platinum and 7.5 ppm cerium (0.5Pt/7.5Ce ppm) ± 20% in commercial ULSD fuel (meeting the EPA specifications for 2007 at less than 15 ppm maximum sulfur content) with a lightly catalyzed diesel oxidation catalyst (DOC) manufactured by CleanAir Systems (Model CPD0950). It is applicable to engines fueled by ultralow-sulfur (15 ppm or less) diesel fuel.

This verification statement describes the performance of the tested technology on the diesel engine and fuels identified in Table 1.

VERIFICATION OF PERFORMANCE

The Clean Diesel Technologies fuel-borne catalyst used with CleanAir System's Diesel Oxidation Catalyst achieved the reduction in tailpipe emissions shown in Table 2 compared to baseline operation with low-sulfur diesel (LSD) fuel.

Table 2. Verified Emissions Reductions for System Consisting of Clean Diesel Technologies fuel-borne catalyst with CleanAir Systems's Diesel Oxidation Catalyst

	Fuel		Mean Emissions Reduction (%)				95% Confidence Limits on the Emissions Reduction (%)			
Device type[a]	Baseline	Controlled	PM[b]	NO_x	HC	CO	PM[b]	NO_x	HC	CO
Degreened	LSD	FBC & ULSD	53	7.4	59	64	49-58	5.8-9.1	56-62	60-69
Aged	LSD	FBC & ULSD	48	2.8	37	54	44-53	1.7-3.9	30-45	50-58

[a] Degreened and Aged are defined in the generic verification protocol.
[b] The verified PM emissions reduction combines reductions related to the control technology and the change in fuel sulfur level.

For the purposes of determining the status of the technology in regard to EPA's voluntary diesel retrofit program, the prospective user is encouraged to contact EPA's Office of Transportation and Air Quality (OTAQ) or visit the retrofit program web site at http://www.epa.gov/otaq/retrofit/.

The APCTVC QA Officer has reviewed the test results and quality control data and has concluded that the data quality objectives given in the generic verification protocol and test/QA plan have been attained. EPA and APCTVC quality assurance staff have conducted technical assessments at the test laboratory and of the data handling. These confirm that the ETV tests were conducted in accordance with the EPA-approved test/QA plan.

This verification statement verifies the emissions characteristics of the *Clean Diesel Technologies fuel-borne catalyst used with CleanAir System's Diesel Oxidation Catalyst* for the stated application. Extrapolation outside that range should be done with caution and an understanding of the scientific principles that control the performance of the technologies. This verification focused on emissions. Potential technology users may obtain other types of performance information from the manufacturer.

In accordance with the generic verification protocol, this verification statement is valid, commencing on the date below, indefinitely for application of *Clean Diesel Technologies fuel-borne catalyst used with CleanAir System's diesel oxidation catalyst* within the range of applicability of the statement.

Original signed by L. A. Mulkey *2/6/04*

Lee A. Mulkey Date
Acting Director
National Risk Management Research Laboratory
Office of Research and Development
United States Environmental Protection Agency

Original signed by A. R. Trenholm *2/5/04*

Andrew R. Trenholm Date
Director
Air Pollution Control Technology Verification Center